

DISTRIBUTION AND ABUNDANCE OF JUVENILE COHO AND STEELHEAD IN GAZOS, WADDELL AND SCOTT CREEKS IN 2000

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ABSTRACT: In September and October 2000 previously sampled representative sites on Gazos Creek and Waddell Creek and in the Scott Creek watershed were evaluated for habitat conditions and sampled by electroshocker to assess distribution and abundance of steelhead and 2000 year class coho. Coho were absent in Gazos and Waddell creeks, as they had been in 1994 and 1997. Coho were present in Scott Creek as only a few individuals at 4 sites, presumably as a result of poor juvenile overwinter survival during El Nino 1997-1998 and/or redd destruction in 2000. The year class is presently not viable south of San Francisco, and its recovery will probably require several cycles of hatchery intervention.

Steelhead abundance in Gazos and Scott creeks was similar to previous years. Waddell Creek steelhead were at less than half strength for the second year in a row, due to low numbers downstream of the East and West forks. Densities were very low immediately downstream of the forks and generally increased with distance downstream. It is likely that there was another fish kill in 2000, although the effects were less severe than in 1999.

Fall sampling of juveniles has been a relatively low effort means of assessing status of coho and steelhead in these streams. Mortality among captured fish has been less than 2%, and the population impact of sampling 5-10 % of the habitat has been negligible.

INTRODUCTION

Since all wild female southern coho (*Oncorhynchus kisutch*) spend one year in the stream and two years in the ocean prior to spawning (Shapovalov and Taft 1954), at least 3 years of study are necessary to determine the status of the three numerically independent year classes. This report presents the results of the ninth consecutive year of sampling for juvenile coho and steelhead (*O. mykiss*) on Scott, Waddell and Gazos creeks. These three cycles of juvenile sampling have demonstrated the importance of winter weather upon coho abundance. The sampling in 2000 was especially important in Scott Creek to determine the possible impact of 1998 (El Nino) storms on overwintering coho survival and also the possible impact of 2000 storms upon redd survival.

Previous surveys have shown wide year-to-year variation in coho abundance within these streams (Smith 1992-1999; Smith and Davis 1993). No coho were captured in 1994 and 1997 in Waddell Creek (Santa Cruz County) and in 1997 in Gazos Creek (San Mateo County) (Gazos Creek was not sampled in 1994). Coho were very rare in Waddell and Gazos creeks in 1992, 1995 and 1998 and in Scott Creek (Santa Cruz County) in 1992, 1994 and 1998. Coho abundance in Scott Creek rebounded in 1995 and 1997 due to spawning by precocial (2-year old) hatchery-reared females (Smith 1995b and 1998a). Similar situations occur elsewhere on the coast, including Redwood Creek in Marin County, where the 1988, 1994 and 2000 years classes were less than 5-10 percent as abundant as other year classes (Smith 2000). These wide coho year to year abundance differences occur because the restricted early spawning period, single spawning attempt, and rigid ages of smolting and spawning (Shapovalov and Taft 1954) make them susceptible to drought, floods or other "disasters" within small watersheds (Smith 1994c). Steelhead, however, have extended spawning periods, can spawn more than once, and are variable in their ages of smolting and maturation (Shapovalov and Taft 1954). Therefore, steelhead juvenile abundance is more likely to indicate yearly rearing habitat quality. In addition, their populations are less affected by, and recover quickly from, bad years. Steelhead juvenile numbers in the same streams have been quite stable (Smith 1992-2000; Smith and Davis 1993).

METHODS

In September and October 2000 ten previously sampled Scott Creek watershed sites were sampled by electroshocking (Table 1). The 3 sites not sampled, on upper and lowermost Scott Creek and on upper Big Creek sites, were unlikely to have coho because of their absence at adjacent, more favorable sites. In September eight previously sampled sites on Waddell Creek were sampled (Table 2). Four sites on the upper west fork and one site on the upper east fork were not sampled because of difficult access and because of lack of coho at other sites in 2000 and throughout the watershed in 1994 and 1997. In September and October seven previously sampled sites on Gazos Creek were sampled (Table 3). Two previously sampled sites were not sampled in 2000 because of lack of coho at other more suitable sites.

At sampled sites on each stream the same habitats were sampled as in previous years if possible. Where winter storms modified some habitats, similar replacement stations were substituted. The length of stream sampled per site was similar to previous efforts (Table 4). The relative abundance of sampled habitats was generally similar to previous years, but also reflected the increase in pool abundance that occurred with scour and wood input during 1998 El Nino storms (Table 4) (Smith 1998a).

The primary goal of the sampling by electroshocker was to look for the presence and abundance of coho, so sampling since 1992 has concentrated on pool and glide habitats, and riffles were seldom sampled. At each site usually 3 to 5 individual habitat "units" (a glide or pool, with its contiguous glide and run habitat) were blocknetted and sampled by 2 to 3 passes with a backpack electroshocker (Smith-Root Type 7, smooth pulse).

Sampled habitats were representative of those available, except for Waddell Creek, where scarce large, deep pools on the main stem could not be sampled by electroshocking. Length, width, depth, cover (escape and overhead), and substrate conditions were determined, and percentage of habitat types assigned for each habitat unit. Rosgen channel types were determined, and relative abundance of pool, glide, run and riffle habitat types estimated for the vicinity of each site (Tables 1-3).

Juvenile fish were measured (standard length, SL) in 5 mm increments, and young-of-year (YOY) steelhead were separated from older fish, based upon length-frequency at each site. Mortality was kept to a minimum by reducing electroshocker voltage (400-200 V) in shallow water and by immediately placing captured fish in a floating live car. Mortality was recorded at the time of length measurements.

RESULTS AND DISCUSSION

Habitat Conditions in 2000

Total rainfall was only about average in 2000, but one very heavy flood occurred in mid February. On Waddell Creek a metal footbridge that had been in place since the late 1980's was torn from its foundation, one large log jam was dislodged, and portions of the channel in the lagoon area were substantially rearranged. Despite this, almost no new large wood was added to the channel, and general pool abundance, distribution and depths at sample sites were changed relatively little from 1999. In the Scott Creek watershed little new large wood was added to the channel, but large wood added in 1998 was reworked at several sites. Some previously sampled pools were substantially changed in depth or configuration, especially on Big Creek and on Scott Creek downstream of Big Creek. A log jam on lower Mill Creek, formed in 1998, was dislodged. On Gazos Creek a debris flow brought numerous small redwoods into the channel near mile 4, a large log jam formed at mile 2.6, and a log jam (from 1998) was relocated 200 feet downstream at mile 2.1. Little additional wood was added to the channel, but several previously sampled pools were substantially modified by the high flows.

On all three streams substantial wood was added in 1998 (Smith 1998c), but little was added over the last 2 winters or during the 1992-1997 period. Large wood additions, especially from long-lasting conifers, apparently occur episodically only during extremely wet years, when numerous landslides deposit upslope trees in the channel, and frequent large floods erode stream banks and topple large riparian trees. Some smaller streamside alders are added to the channel in most average or wet years, but they easily rearrange and break up quickly; habitat benefits, although important, are smaller and of rather brief duration.

Coho

Scott Creek. Only 7 coho were captured at 4 sites in the Scott Creek watershed, the lowest coho abundance in 10 years of sampling (Table 4). The few coho captured were from lower Mill Creek and on Scott Creek between Big Creek and mile 5. Those sites have been the most "flood-proof" sites in past years (Smith 1998c). However, in 2000 access to the creek was delayed until mid January, and apparently most coho then entered and quickly spawned prior to the flood in mid February. In addition, it is possible that relatively few coho adults were even present in 2000. In summer 1997 juvenile production was actually moderately good (Table 4), due to spawning by precocial hatchery-reared females (Smith 1998a). However, overwinter survival of the year class may have been poor due to frequent and sustained floods during the El Nino winter and spring of 1998. The near-elimination of a relatively strong 1997 juvenile coho year class also occurred in Redwood Creek in Marin County (Smith 2000).

The low apparent abundance in Scott Creek in 2000 means that the year class is no longer viable without substantial intervention. However, rebuilding the year class from precocial hatchery-reared fish of the 2001 year class is not very likely. Wild and hatchery production in 1998 was very poor (Smith 1998c), and few adults are likely to be present in winter 2000-2001, other than precocial males from the strong 1999 year class. At the present time only one of the three year classes (1999) in Scott Creek appears viable, and all coho restoration must be rebuilt from that year class.

Waddell and Gazos Creeks. No coho were captured in Waddell or Gazos creeks in 2000. The absence of coho was expected, as none were captured in 1997 in either stream, or in 1994 in Waddell Creek. The year class is unlikely to be restored without substantial intervention, but that first requires rebuilding the year class in Scott Creek.

Steelhead

Scott Creek. Overall YOY steelhead abundance in 2000 (78 / 100 feet) was slightly above the average of the previous 9 sample years (67 / 100 feet) (Table 5). However, combined abundance for steelhead and coho was lower than for most other years. Four of the 5 lowest previous steelhead year class abundances were in years of abundant coho (1988, 1993, 1996, 1999), when steelhead abundance in pools was probably suppressed by coho.

The most pronounced steelhead density result in 2000 was the extremely low abundance of steelhead downstream of Little Creek, with a density less than 20% of the watershed average. The heavily shaded Upper Ford site at mile 5.85 on Scott Creek had relatively low steelhead abundance, as it has had in most years.

The geographical pattern of YOY steelhead lengths was similar to previous years. Fish were larger on Scott Creek downstream of Big Creek, where summer flows are highest and shading is less, and fish were relatively small on Mill Creek and upper Scott Creek, where flows are low and shading is very heavy (Figure 1). YOY steelhead sizes have

changed little between wet and dry years at upstream sites, where flows are always low by summer (Figure 3). On Scott Creek downstream of Little Creek YOY steelhead growth been substantially better in wetter years, like in 1995 and 1998, and at other sites growth was somewhat better only during the extremely wet 1998 year (Figure 3).

Yearling steelhead density was relatively low (Table 5) and similar to 1988 and 1997. In 1988 this was probably because fewer pools, preferred habitat of yearling steelhead, were sampled. The low values in 1997 and 2000 apparently reflect low YOY numbers in the previous year and/or poor overwinter survival due to severe flooding.

Waddell Creek. As in 1999, overall steelhead abundance in 2000 (YOY 30 / 100 feet) was about half of the average of previous years (Table 5). Densities were similar to previous years on the lower portions of the East and West Forks, but very low on the main stem (Table 2). Abundance was extremely low (9 / 100 feet) immediately downstream of the forks but generally increased downstream. In addition, most of the fish present downstream of the forks were concentrated in riffles and heads of pools, as if food scarcity was a major problem. However, at the time of sampling in September aquatic insects were reasonably common. In 1999 the apparent fish kill was even more severe, with low densities throughout the main stem (Smith 1999). No reason is known for the apparent fish loss, but the sharp steelhead decrease begins at the Camp Herbert backpacker campground.

As in previous years YOY steelhead were bigger on the main stem, where summertime flows are greater and shading is less, than on the West Fork, which has low summer flows and is heavily shaded (Figure 2). On the West Fork growth was somewhat better in the extremely wet 1998 year, but otherwise fish sizes at upstream sites have varied little among years (Figure 4).

Gazos Creek. YOY steelhead density was below average, but similar to previous years (Table 5). Yearling density was lower than all previous years, apparently reflecting the impact of the February flood on overwinter survival. As in previously years, the density at the site downstream of Old Woman Creek was less than half that of other sites. The lower 2 miles of stream are heavily shaded and appear to suffer in many years from fine sediment from Old Woman Creek. Clean spawning gravels are scarce downstream of Old Woman Creek.

YOY steelhead on Gazos Creek have generally been similar in size to those on upstream sites of Waddell and Scott creeks (Figures 1 and 2). However, the relatively scarce fish downstream of Old Woman Creek have tended to be larger (Figure 2), especially in 1999 and 2000 (Figure 5). As on upstream sites on Scott and Waddell creeks, sizes have generally changed little between wet and dry years. However, in 2000 YOY steelhead on Gazos Creek were generally somewhat bigger (Figure 5).

MANAGEMENT IMPLICATIONS

Coho

The situation for coho in these three streams is somewhat worse than, but similar to, that of 1992-1994. Only a single strong year class is present (the 1993, 1996, 1999 year class). The other 2 year classes are either gone (the 1994, 1997, 2000 year classes for Gazos and Waddell creeks) or very weak (the 1992, 1994, 1998 and 2000 year classes for Scott Creek and the 1992, 1995 and 1998 year classes for Gazos and Waddell creeks). The single strong year class (1993) on Scott in the earlier period was able to rebuild the other two because accelerated growth of hatchery-reared coho produced precocial (2-year old) spawning females. The role of hatchery rearing again appears crucial to rebuilding 3 viable year classes.

Alternatively, if the single strong year class is crippled or eliminated by drought or flood in 2002, coho will be essentially extirpated south of San Francisco Bay. Summer rearing conditions for coho are suitable in the 3 streams, which have cool, flat habitat. In addition, pools are frequent on Scott and Waddell creeks. However, drought in 1991, when adult access wasn't possible until March, and floods in 1992, 1995, 1997, 1998 and 2000, which destroyed many redds, have nearly eliminated coho. These drought and flood impacts apparently extend widely in central California, as Redwood Creek in Marin County also has one very weak year class (1988, 1994 and 2000) (Smith 2000). Most alarmingly, a single extreme winter, like 1998, may weaken or eliminate 2 year classes, by impacting overwintering juveniles and by also destroying redds.

Steelhead

Although also federally listed as threatened, steelhead in these streams are doing well. Only the apparent fish kills on the main stem of Waddell Creek in 1999 and 2000 raise concern. Densities have fluctuated by only a factor of about 2 from year to year (Table 5), generally increasing in years of higher summer stream flow. Late-spawning steelhead have apparently not been impacted by floods as have coho. Fish at upstream shaded, low summer flow sites have generally been smaller than fish at downstream sites in Waddell and Scott creeks; Gazos Creek fish have been similar in size to upstream sites on the other two streams. Little size change in YOY fish has occurred between wet and dry years, except at downstream sites or with large summer flow increases. For most sites the strongest effect of summer stream flow appears to be on density, rather than on growth rate.

Monitoring

Fall monitoring of juveniles at representative, repeatable sites on the three streams has required about 200-250 man hours per year (using a 2-person sampling team) and has provided a valuable index to steelhead and coho status. Electroshocking is the only

effective way to sample juveniles at many of the sites, because snorkeling would not be effective in shallow, small or complex habitats or at heavily shaded sites. Mortality from electroshocking has been low, averaging 1% among captured steelhead and coho in four streams in 2000 (Table 6). Mortality in previous years has been similar, although it has exceeded 2 % in deeper, complex habitats or under warmer water conditions (Smith 1996-1999). In addition, since only 3-10 % of the habitat is sampled, the loss to the total stream population is less than 0.1%.

Trapping of adults or smolts on these streams would provide valuable abundance data for other important life history stages. However, it would also probably require very expensive permanent weirs, and/or provide relatively inaccurate data. Trapping would be inefficient during much of the high-flow adult migration period and during the variable early portion of the smolt migration period. Past experience on Waddell Creek has indicated that much of the adult or smolt migrations occurs during high flow events, when simple trap systems fished poorly (Smith 1992).

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Table 1. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Scott Creek in September and October 2000. (Site #s agree with earlier reports).

Site	Mile >Hwyl	Chan Type	%Habitat Available				%Habitat Sampled				Sample Length (Feet)	#SHT		Coho
			PL	GL	RN	RF	PL	GL	RN	RF		+0	+1	
1 < Little Creek	1.9	C3	50	25	20	5	60	8	32	--	252	35 (15)	5 (2)	--
Big Creek	2.15													
2 Pullout > Big Creek	2.55	C4	50	30	15	5	84	7	9	--	225	125 (66)	12 (6)	2 (1)
3 < Mill Creek	3.05	C4	50	30	15	5	71	25	5	--	204	95 (58)	13 (7)	--
4 < Swanton Road	3.55	C4	50	30	15	5	67	31	2	--	216	133 (65)	20 (10)	--
5 Cattle guard	4.25	C4	50	30	15	5	79	21	--	--	192	184 (86)	29 (16)	2 (1)
7 Pullout < Big Cr. Gate	4.9	C4	50	30	15	5	86	10	3	--	145	175 (149)	9 (7)	2 (1)
9 0.15 mile > bridge	5.15	C4	45	25	20	10	90	10	--	--	117	139 (137)	14 (12)	--
11 Upper Ford	5.85	C3	50	30	15	5	83	8	7	2	249	89 (45)	11 (5)	--
12 Big Creek/ Swanton Road		C3	30	15	40	15	100	--	--	--	91	39 (57)	3 (3)	--
13 Mill Creek <Swanton Road		C3	50	20	20	10	95	5	--	--	119	109 (103)	8 (7)	1 (1)
Totals											1810	1123	124	7
Mean of 10 Sites			48	26	19	7	81	13	6	--		(78)	(7)	(0.4)

Table 2. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Waddell Creek in September 2000. (Site #s agree with earlier reports). Apparent summer fish kill extended from Camp Herbert (6) downstream through site 1.

Site	Mile >Hwy1	Chan Type	%Habitat Available				% Habitat Sampled				Sample Length (Feet)	#SHT		COHO
			PL	GL	RN	RF	PL	GL	RN	RF		+0	+1	
1 First bridge	0.6	C4	50	30	15	5	69	31	--	--	142	25 (18)	2 (1)	--
2 < Alder Camp	1.35	C4	50	35	10	5	67	22	11	--	158	57 (46)	6 (5)	--
3 Twin Redwoods	1.8	C4	50	30	15	5	56	17	23	4	201	49 (29)	10 (5)	--
4 Periwinkle	2.2	C4	45	30	20	5	51	14	23	13	148	21 (16)	4 (3)	--
5 Pullout < Herbert	2.6	C3	55	25	15	5	65	--	29	7	123	25 (23)	2 (2)	--
6 Camp Herbert	3.1	C3	50	25	15	10	88	4	8	--	267	24 (9)	--	--
7 E Fork > Ford	3.2	C3	45	25	20	10	54	40	6	--	240	109 (51)	3 (1)	--
8 W Fork	3.3	C4	40	30	25	5	73	20	7	--	232	93 (46)	6 (3)	--
Totals											1511	403	33	0
Mean of 8 Sites			47	29	17	7	65	19	13	3		(30)	(3)	(0)
Mean of sites 7-8												(49)	(2)	(0)

Table 3. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Gazos Creek in September and October 2000. Site #s agree with earlier reports.

Site	Mile >Hwy1	Chan Type	%Habitat Available				% Habitat Sampled				Sample Length (Feet)	#SHT		COHO
			PL	GL	RN	RF	PL	GL	RN	RF		+0	+1	
1	0.9	C4	40	30	20	10	85	15	--	--	198	23 (14)	14 (7)	--
Old Woman Creek	2.05													
2A	2.1	C4	30	30	25	15	66	18	16	--	168	42 (28)	14 (8)	--
2B (G/H)	2.8	C4	40	25	25	10	89	8	3	--	120	36 (32)	5 (4)	--
3 (<J)	3.15	B4	40	25	25	10	48	28	24	--	142	42 (30)	6 (4)	--
4	4.4	B4	40	25	25	10	71	20	9	--	149	79 (56)	8 (6)	--
5	4.85	B4	40	25	25	10	81	6	13	--	136	44 (34)	9 (7)	--
7A (>U)	5.3	B1	40	10	35	15	84	12	4	--	235	132 (66)	16 (8)	--
Totals											1036	392	72	0
Mean of 7 Sites			39	24	26	11	75	15	10	0		(37)	(6)	0

Table 4. Number of sites, amount and type of habitat sampled, number of coho collected and estimated density (per 100 feet) for Scott, Waddell, Gazos and Redwood Creeks in 1988 and 1992 – 2000.

Stream and Date		Number of Sites Sampled	Length (feet)	Habitat Percent				# of Sites with Coho	# of Coho	Coho Density (/100')
				PL	GL	RN	RF			
<u>Scott Creek</u>										
Jul – Sep	1988	14	3535	41	25	21	12	84	384	15.5
Aug – Oct	1992	13	1624	66	30	4	0	46	42	4.3
Jan	1994	11	1554	49	32	19	0	100	376	27.2
Aug	1994	13	1744	59	36	6	0	46	17	1.1
Oct	1995	12	1686	59	32	8	1	92	223	14.2
Oct – Nov	1996	12	1684	62	30	8	1	100	473	33.0
Aug – Sep	1997	13	1865	64	24	11	0	62	145	9.3
Sep – Oct	1998	11	1753	77	16	6	1	64	34	1.8
Oct	1999	10	1430	81	17	2	0	90	328	29.2
Sep – Oct	2000	10	1810	81	13	6	0	40	7	0.4
<u>Waddell Creek</u>										
Jun – Aug	1988	8	1817	54	19	23	5	63	19	1.3
Jul – Aug	1992	13	2858	67	31	2	0	38	19	0.6
Oct – Dec	1993	12	1857	38	21	28	14	75	58	3.6
July	1994	12	2367	66	24	7	2	0	0	0
Sep	1995	12	2498	64	24	10	2	58	24	1.1
Aug – Sep	1996	14	2491	69	21	8	2	93	302	12.5
Aug – Sep	1997	11	1873	58	32	8	1	0	0	0
Sep – Oct	1998	10	2083	76	18	5	1	20	7	0.3
Oct	1999	10	1558	78	19	4	0	40	66	3.1
Sep	2000	8	1511	65	19	13	3	0	0	0

Table 4 (continued)

Stream and Date		Number of Sites Sampled	Length (feet)	Habitat Percent				# of Sites with Coho	# of Coho	Coho Density (/100')
				PL	GL	RN	RF			
<u>Gazos Creek</u>										
Aug	1992	2	275	44	56	0	0	0	0	0
Jan	1994	4	503	65	22	12	1	50	9	2.2
Nov	1995	4	425	58	19	21	3	25	1	0.2
Sep	1996	5	830	49	27	12	13	100	33	4.9
Aug	1997	5	827	45	28	17	10	0	0	0
Aug – Sep	1998	8	1529	65	14	11	10	25	10	0.4
Sep – Oct	1999	9	1475	79	18	2	1	67	79	6.2
Sep – Oct	2000	7	1036	75	15	10	0	0	0	0
<u>Redwood Creek</u>										
Jun – Sep	1992	4	1032	37	40	5	7	100	426	45.3
Jun – Aug	1993	4	951	48	25	18	9	100	355	46.3
July	1994	7	1287	58	25	12	6	43	24	1.9
Aug	1995	4	796	41	30	19	10	100	308	42.0
Nov	1996	3	604	51	31	11	7	100	214	38.8
Sep – Oct	1997	5	984	72	18	9	1	60	209	23.3
Oct	1998	5	1174	59	25	15	1	100	327	31.6
Oct	2000	6	1077	71	27	3	0	33	14	1.1

Table 5. Number of sites, amount and type of habitat sampled and estimated density (per 100 feet) of steelhead for Scott, Waddell, Gazos and Redwood Creeks in 1988 and 1992 - 2000.

Stream and Date		Number of Sites Sampled	Length (feet)	PL	Habitat Percent			Density	
					GL	RN	RF	Age 0+	Age 1/2+
<u>Scott Creek</u>									
Jul – Sep	1988	14	3535	41	25	21	12	57	7
Aug – Oct	1992	13	1624	66	30	4	0	89	21
Jan	1994	11	1554	49	32	19	0	39	21
Aug	1994	13	1744	59	36	6	0	52	18
Oct	1995	12	1686	59	32	8	1	90	10
Oct – Nov	1996	12	1684	62	30	8	1	35	20
Aug – Sep	1997	13	1865	64	24	11	0	68	7
Sep – Oct	1998	11	1753	77	16	6	1	113	10
Oct	1999	10	1430	81	17	2	0	62	10
Sep – Oct	2000	10	1810	81	13	6	0	78	7
<u>Waddell Creek</u>									
Jun – Aug	1988	8	1817	54	19	23	5	45	7
Jul – Aug	1992	13	2858	67	31	2	0	56	10
Oct – Dec	1993	12	1857	38	21	28	14	54	8
July	1994	12	2367	66	24	7	2	61	19
Sep	1995	12	2498	64	24	10	2	79	14
Aug – Sep	1996	14	2491	69	21	8	2	62	15
Aug – Sep	1997	11	1873	58	32	8	1	71	7
Sep – Oct	1998	10	2083	76	18	5	1	80	7
Oct	1999	10	1558	78	19	4	0	27	4
Sep – Oct	2000	8	1511	65	19	13	3	30	3

Table 5 (continued)

Stream and Date		Number of Sites Sampled	Length (feet)	PL	Habitat Percent				Density	
					GL	RN	RF	Age 0+	Age 1/ 2+	
<u>Gazos Creek</u>										
Aug	1992	2	275	44	56	0	0	24	12	
Jan	1994	4	503	65	22	12	1	29	9	
Nov	1995	4	425	58	19	21	3	68	14	
Sep	1996	5	830	49	27	12	13	34	12	
Aug	1997	5	827	45	28	17	10	36	8	
Aug – Sep 1998		8	1529	65	14	11	10	53	7	
Sep – Oct 1999		9	1475	79	18	2	1	51	8	
Sep – Oct 2000		7	1036	75	15	10	0	37	6	
<u>Redwood Creek</u>										
Jun – Sep 1992		4	1032	37	40	5	7	23	4	
Jun – Aug 1993		4	951	48	25	18	9	56	4	
Oct	1994	5	1018	83	10	4	3	34	6	
Aug	1995	4	796	41	30	19	10	96	4	
Nov	1996	3	604	51	31	11	7	33	11	
Sep – Oct 1997		5	984	72	18	9	1	15	5	
Oct	1998	5	1174	59	25	15	1	47	4	
Oct	2000	6	1077	71	27	3	0	39	15	

Table 6. Coho and steelhead killed and captured (/) by electroshocking and mortality rate (%) on Scott, Waddell, Gazos and Redwood creeks in September and October 2000.

	-----Steelhead-----				Coho	
	Age 0+ Kill/Capt	%	Age 1+ Kill/Capt	%	Age 0+ Kill/Capt	%
Scott Creek	11 / 1123	1.0	0 / 124	0	0 / 7	0
Waddell Creek	3 / 403	0.7	0 / 33	0	0	0
Gazos Creek	5 / 392	1.3	0 / 72	0	0	0
Redwood Creek	5 / 266	1.9	0 / 109	0	0 / 1	0
Totals	24 / 2184	1.1	0 / 338	0	0 / 8	0
Overall	24 / 2522 1.0					

Figure 1. Standard Lengths (mm) of YOY steelhead from three Scott Creek sites in September and October 2000. Site 2 sizes were typical of Scott Creek sites 2-7 and lower Big Creek. Site 11 sizes were typical of Scott Creek sites 8-11 and lower Mill Creek.

	Site 1	Site 2	Site 11
25 – 29			1
30 – 34			
35 – 39		**5	****8
40 – 44		*****17	*****22
45 – 49	1	*****28	*****32
50 – 54		*****16	*****12
55 – 59	****8	*****21	****8
60 – 64	***7	*****15	**4
65 – 69	***6	***7	
70 – 74	***7	***7	
75 – 79	1	1	
80 – 84		*2	
85 – 89	1		
90 – 94	1		
95 – 99	*3		

Figure 2. Standard lengths (mm) of YOY steelhead from two Waddell Creek sites and two Gazos Creek sites in September and October 2000. Site 2 sizes on Waddell Creek were typical of main stem sites (1-6). Site 8 sizes on Waddell Creek are typical of West Fork sites. Site 4 sizes on Gazos Creek were typical of Gazos Creek sites 2A – 7A (upstream of Old Woman Creek).

	Waddell Creek-----		Gazos Creek-----	
	Site 2	Site 8	Site 1	Site 4
35 – 39		*3		
40 – 44		*****12		
45 – 49		*****19		*****10
50 – 54		*****18		*****24
55 – 59	*2	*****15	1	*****22
60 – 64	**5	*****12		*****13
65 – 69	***7	***7	*3	***7
70 – 74	*****13	*3	*****12	***6
75 – 79	*****11	*3	**4	1
80 – 84	***7		1	
85 – 89	*2		*2	
90 – 94	****8			
95 – 99	1			

Figure 3. Standard Lengths (mm) of YOY steelhead from Scott Creek in October 1995, September 1997, October 1998, October 1999 and September and October 2000. (Years arranged from driest to wettest)

	Site 1 2000	Sites A&1 1999	Sites A&1 1997	Site A 1995	Site 1 1998
40 – 44			*4		
45 – 49		**6	**8		
50 – 54	1	***10	*****15	1	2
55 – 59	****8	**8	*****16	**7	*****23
60 – 64	***7	***9	*****18	***11	*****36
65 – 69	***6	2	*****15	*****29	*****36
70 – 74	***7	*5	***11	*****19	*****38
75 – 79	1	2	***10	*****20	***10
80 – 84			*3	***13	*3
85 – 89	1			***12	***9
90 – 94	1		1	**8	*3
95 – 99	*3		1	*3	*3
100-104				*4	

	Site 2 2000	Site 4 1999	Site 2 1997	Site 2 1995	Site 2 1998
30 – 34			2		
35 – 39	*5	*4	*4	*4	1
40 – 44	*****17	**8	***12	*****33	*5
45 – 49	*****28	*****17	*****18	*****29	*****22
50 – 54	*****16	*****27	*****17	*****25	*****48
55 – 59	*****21	*****18	*****18	*****19	*****50
60 – 64	*****15	*****17	***13	*****27	*****35
65 – 69	**7	**6	1	*****16	*****16
70 – 74	**7	*3	*4	*****16	***10
75 – 79	1		1	***11	*5
80 – 84	2			2	1

	Site 11 2000	Site 11 1999	Sites 9&11 1997	Sites 9&11 1995	Sites 9&11 1998
25 – 29	1				
30 – 34		1	*3	*5	*5
35 – 39	**8	***10	*****22	*****17	*****20
40 – 44	*****22	***11	*****38	*****25	*****45
45 – 49	*****32	***12	*****34	*****23	*****44
50 – 54	***12	***10	*****31	*****26	*****48
55 – 59	**8	**8	*****31	*****19	*****26
60 – 64	*4	*3	***14	***9	***14
65 – 69	1	*3	***10	*4	***11
70 – 74	2	1		2	1

Figure 4. Standard Lengths (mm) of steelhead from Waddell Creek site 8 in 2000, 1999, 1997, 1995 and 1998 (driest to wettest).

	2000	1999	1997	1995	1998
35 – 39	*3		**7	2	
40 – 44	****12	1	****13	***10	1
45 – 49	*****19	****12	*****19	****14	*****22
50 – 54	*****18	*****19	*****27	*****25	*****28
55 – 59	****15	***11	*****27	****16	*****34
60 – 64	****12	****12	***9	****12	****15
65 – 69	**8	**6	**7	**8	*****20
70 – 74	*3	*5	*3	**7	*****18
75 – 79	*3	*4	2	**6	***10
80 – 84				*5	*4
85 – 89					*4
90 – 94					1

Figure 5. Standard lengths (mm) of steelhead from sites 1&2 and site 4 on Gazos Creek in August 1997, August and September 1998, September and October 1999, and September and October 2000.

	Sites 1 & 2 1997	Sites 1 & 2 1998	Site 1 1999	Site 1 2000
40 – 44	2	1		
45 – 49	2	*****18		
50 – 54	****13	*****28		
55 – 59	*****18	*****18		1
60 – 64	****13	*****33	*3	
65 – 69	**6	****12	***9	*3
70 – 74	***11	*3	***11	****12
75 – 79	**6	*3	***11	*4
80 – 84	2		*3	1
85 – 89			*3	2
90 – 94		1		

	Site 4 1997	Site 4 1998	Site 4 1999	Site 4 2000
30 – 34	2		1	
35 – 39	*5	1	2	
40 – 44	****14	****14	*****23	
45 – 49	****13	*****33	*****39	***10
50 – 54	*****20	*****25	*****27	*****24
55 – 59	****14	*****17	*****21	*****22
60 – 64	****12	**7	*****16	****13
65 – 69	*4	*4	*5	**7
70 – 74				**6